

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
ME - SEMESTER-I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2713301

Date: 31/12/2015

Subject Name: Numerical Methods for Civil Engineering

Time: 2:30 pm to 5:00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Define following types of errors (i) Absolute errors, (ii) Relative errors, (iii) Round-off errors, (iv) Truncation errors, and (vi) Inherent errors **07**
- (b) Using the method of False Position, find a real root of the equation $x^4 + 6x - 10 = 0$ correct up to three decimal places. **07**

- Q.2** (a) Using Newton-Raphson method, find a root of $x - 3\cos x = 0$ correct up to three significant figures. **07**
- (b) Solve following systems of equation using Gauss-Jordan method. **07**

$$\begin{aligned} 3x + y + 3z &= 9 \\ 4x + y + 7z &= 19 \\ 6x + 2y + 5z &= 18 \end{aligned}$$

OR

- (b) Explain Gauss Seidel method for solution of linear simultaneous equations and give its algorithm. **07**

- Q.3** (a) Use modified Euler's method of second order to find $y(0.2)$, given that $dy/dx = x - y^2$, $y(0) = 1$ with $h = 0.05$. **07**
- (b) Using the finite difference method, compute the deflection at $L/4$ interval of a simply supported beam subjected to point load 'W' at the centre of beam of span 'L'. Take EI constant. **07**

OR

- Q.3** (a) Use Runge- Kutta method of fourth order to find $y(1.1)$, given that $dy/dx = x - y^2$, $y(1) = 1$ with $h = 0.05$. **07**
- (b) A steady state heat balance for a 8 m rod can be represented as, **07**
- $$d^2T/dx^2 = -h(T_a - T). \text{ Take } h = 0.01\text{m}^{-2} \text{ } T_a = 25^\circ\text{C}, T(0) = 30^\circ\text{C} \text{ and } T(8) = 160^\circ\text{C}.$$
- Solve the differential equation using finite difference approach with $\Delta x = 2\text{m}$.

- Q.4** (a) Determine the numerical value of integration of $\log_e x$ for limit 2 to 3, using three-point Gauss-Quadrature rule. **07**
- (b) Explain the use of Eigen value problem in Structural Engineering. Give basic steps for solution of Eigen value problem. **07**

OR

- Q.4** (a) Determine the largest Eigen value and corresponding eigenvector of the matrix **07**

$$\begin{bmatrix} 5 & 2 & 0 \\ 3 & 4 & 0 \\ -1 & 2 & 6 \end{bmatrix}$$

- (b) Explain the Fourier Transform method. 07

- Q.5** (a) Enlist and compare methods for curve fitting. 07

- (b) Define Interpolation. Find the Lagrange's interpolating polynomial from the following data: Hence find $f(0.7)$. 07

x	0	1	4	5
$f(x)$	1	3	24	39

OR

- Q.5** (a) By the method of least squares, find the straight line that best fits the following data: 07

x	-2	-1	0	1	2
y	8	12	17	22	28

- (b) What is numerical integration? Derive Trapezoidal and Simpson's 1/3 rule. 07
